CLAIMS

We claim:

1. An encapsulant composition comprising:

a resin material;

a flexibilizing agent; and

a filler material.

2. The composition of claim 1 wherein said resin material is selected from the group consisting of epoxy and cyanate ester resins.

3. The composition of claim 2 wherein said resin material is an epoxy resin and comprises cycloaliphatic epoxides.

4. The composition of claim 3 wherein said cycloaliphatic epoxides are derived from unsaturated aromatic hydrocarbon compounds.

5. The composition of claim 2 wherein said resin material is an epoxy resin and comprises glycidyl ethers.

6. The composition of claim 2 wherein said resin material is a cyanate ester resin and comprises at least a di-cyanate ester resin.

7. The composition of claim 2 wherein said resin material comprises about 20 percent to about 55 percent by weight of said composition.

8. The composition of claim 1 wherein said flexibilizing agent is selected from the group consisting of polysulfones, polyetherimide, polyamideimides, polyarylene ethers, polyesters, polyarylates, polycarbonates, polyurethanes, hydroxy-terminated polysulfone oligomers, 1,4-butane-diol diglycidyl ethers, neopentlyglycol diglycidyl ether, cyclohexane dimethanol diglycidyl ether, trimethylol ethane triglycidyl ethers, dibromoneopentylglycol glycidyl ethers, propoxylated glycerol polyglycidyl ether, polypropylene glycol glycidyl ether, polyglycidyl ether of castor oil, dimer acid diglycidyl esters, resorcinol diglycidyl ether, epoxidized propylene glycol dioleates, epoxy esters, 1,2-tetradecane oxides, internally epoxidized 1,3-butadiene homopolymers, diglycidyl ether, glycidyl glycidate, bis(2,3-epoxy-2-methlpropyl)ether, polyglycoldiepoxides, E-caprolactone triol, copolymers of butadiene and styrene, butyl rubber, neoprene, polysiloxanes, carboxyl terminated poly n-butylacrylates, maleic anhydride terminated rubbers, epoxy functionalized rubbers, fluoridized rubbers, and hydroxylated or carboxylated EPDM rubbers.

9. The composition of claim 8 wherein said flexibilizing agent comprises about 1 percent to about 5 percent by weight of said composition.

10. The composition of claim 1 wherein said filler material is selected from the group consisting of silica, aluminum oxide, alumina, aluminum nitride, silicon nitride, silicon carbide, beryllium oxide, boron nitride, zirconates and diamond powder.

11. The composition of claim 10 wherein said filler material is a zirconate and comprises zirconium tungstate having a negative expansion property.

12. The composition of claim 10 wherein said filler material comprises about 44 percent to about 75 percent by weight of said composition.

13. The composition of claim 10 wherein said filler material comprises substantially spherical or spheroidal particles, each particle having a diameter of less than about 41 microns.

14. The composition of claim 13 wherein a portion of each of said spherical or spheroidal particles includes a layer of coupling agent positioned thereon.

15. The composition of claim 1 further including a catalyst material.

16. The composition of claim 15 wherein said catalyst material is selected from the group consisting of imidazoles, tertiary amines, benzyldimethylamine, 1,3-tetramethyl butane diamine, tris (dimethylaminomethyl) phenol, pyridine, triethylendiamine, aluminum chloride, boron trifluoride, ferric chloride, titanium chloride, zinc chloride, sodium acetate, disodium cyanide, sodium cyanate, potassium thiocyanate, sodium bicarbonate, sodium boronate, and cobalt, manganese, iron, zinc, or copper acetylacetonate, octoate, or naphthenates .

17. The invention of claim 1 wherein said composition has a viscosity of about 750 centipoise to about 50,000 centipoise at a temperature of about 25 degrees Celsius.

18. An electronic package comprising:

a substrate having an upper surface;

SUB A7

a semiconductor chip mounted on a portion of said upper surface of said substrate and electrically coupled to said substrate, said semiconductor chip having a bottom surface and at least one edge surface being substantially perpendicular to said bottom surface; and

a material positioned on at least said portion of said upper surface of said substrate and against at least a portion of said

at least one edge surface of said semiconductor chip, said material being an encapsulant composition which includes a resin material, a flexibilizing agent and a filler material.

19. The electronic package of claim 18 wherein said substrate comprises an organic material.

20. The electronic package of claim 19 wherein said organic material includes a resin selected from the group consisting of epoxies, polyimides, cyanates, fluoropolymers, benzocyclobutenes, polyphenylenesulfides, polysulfones, polyetherimides, polyetherketones, polyphenylquinoxalines, polybenzoxalines, polybenzoxazoles, polyphenylbenzobisthiazoles, dicyclopentadienes, and halide free resins .

21. The electronic package of claim 19 wherein said substrate further includes a reinforcing material.

22. The electronic package of claim 21 wherein said reinforcing material is selected from the group consisting of organic woven fibers, organic non-woven fibers, inorganic woven fibers, and inorganic non-woven fibers.

23. The electronic package of claim 18 wherein said substrate comprises a ceramic material.

24. The electronic package of claim 23 wherein said substrate further includes a layer of glass material therein.

25. The electronic package of claim 18 wherein said resin material is selected from the group consisting of epoxy and cyanate ester resins.

26. The electronic package of claim 25 wherein said resin material is an epoxy resin and comprises cycloaliphatic epoxides.

27. The electronic package of claim 26 wherein said cycloaliphatic epoxides are derived from unsaturated aromatic hydrocarbon compounds.

28. The electronic package of claim 25 wherein said resin material is an epoxy resin and comprises glycidyl ethers.

29. The electronic package of claim 25 wherein said resin material is a cyanate ester resin and comprises at least a di-cyanate ester resin.

30. The electronic package of claim 25 wherein said resin material comprises about 20 percent to about 55 percent by weight of said composition.

31. The electronic package of claim 18 wherein said flexibilizing agent is selected from the group consisting of polysulfones, polyetherimide, polyamideimides, polyarylene ethers, polyesters, polyarylates, polycarbonates, polyurethanes, hydroxy-terminated polysulfone oligomers, 1,4-butane-diol diglycidyl ethers, neopentlyglycol diglycidyl ether, cyclohexane dimethanol diglycidyl ether, trimethylol ethane triglycidyl ethers, dibromoneopentylglycol glycidyl ethers, propoxylated glycerol polyglycidyl ether, polypropylene glycol glycidyl ether, polyglycidyl ether of castor oil, dimer acid diglycidyl esters, resorcinol diglycidyl ether, epoxidized propylene glycol dioleates, epoxy esters, 1,2-tetradecane oxides, internally epoxidized 1,3-butadiene homopolymers, diglycidyl ether, glycidyl glycidate, bis(2,3-epoxy-2-methlpropyl)ether, polyglycoldiepoxides, E-caprolactone triol, copolymers of butadiene and styrene, butyl rubber, neoprene, polysiloxanes, carboxyl terminated poly n-butylacrylates, maleic anhydride terminated rubbers, epoxy functionalized rubbers, fluoridized rubbers, and hydroxylated or carboxylated EPDM rubbers.

32. The electronic package of claim 31 wherein said flexibilizing agent comprises about 1 percent to about 5 percent by weight of said composition.

33. The electronic package of claim 18 wherein said filler material is selected from the group consisting of silica, aluminum oxide, alumina, aluminum nitride, silicon nitride, silicon carbide, beryllium oxide, boron nitride, zirconates, and diamond powder.

34. The electronic package of claim 33 wherein said filler material is a zirconate and comprises zirconium tungstate having a negative expansion property.

35. The electronic package of claim 33 wherein said filler material comprises about 44 percent to about 75 percent by weight of said composition.

36. The electronic package of claim 33 wherein said filler material comprises substantially spherical or spheroidal particles, each particle having a diameter of less then about 41 microns.

37. The electronic package of claim 36 wherein a portion of each of said spherical or spheroidal particles includes a layer of coupling agent positioned thereon.

38. The electronic package of claim 18 wherein said composition further includes a catalyst material.

39. The electronic package of claim 38 wherein said catalyst material is selected from the group consisting of imidazoles, tertiary amines, benzyldimethylamine, 1,3-tetramethyl butane diamine, tris (dimethylaminomethyl) phenol, pyridine, triethylendiamine, aluminum chloride, boron trifluoride, ferric chloride, titanium chloride, zinc chloride, sodium acetate, disodium cyanide, sodium cyanate, potassium thiocyanate, sodium

bicarbonate, sodium boronate, and cobalt, manganese, iron, zinc, or copper acetylacetonate, octoate, or naphthenates.

40. The invention of claim 18 wherein said composition has a viscosity of about 750 centipoise to about 50,000 centipoise at a temperature of about 25 degrees Celsius.

41. A method of making an encapsulant composition, the method comprising the steps of:

providing a first quantity of resin material;

adding to said first quantity of resin material a second quantity of flexibilizing agent;

adding to said first quantity of resin material a third quantity of filler material; and

blending said resin material.

42. The method of making the composition of claim 41 wherein said adding a second quantity of flexibilizing agent comprises homogenizing said flexibilizing agent in said first quantity of resin material by reacting said resin material and said flexibilizing agent together at a temperature of greater than about 100 degrees Celsius.

43. The method of making the composition of claim 41 wherein said step of blending is performed under vacuum.

Add C7